DUAL CONNECTIVITY MANAGEMENT

TECHNICAL FIELD

[0001] The present application relates to wireless communications and, in particular, dual connectivity management in a heterogeneous network.

BACKGROUND

[0002] The expected increase in wireless data transmissions may mean that there will be a need to deploy more network capacity. One efficient way to increase the network capacity is by deploying small cells for offloading purposes or offloading cells in general. These small cells can be deployed on the same or separate carriers relative to the macro cell, and the mixed environment with macro/large cells and small cells are often referred to heterogeneous networks (hetnets). Use of hetnets may provide opportunities for offloading traffic from the macro cells to, for example, a higher speed or a higher capacity small cell.

[0003] The heterogeneous network may include one or more wireless access points, or base stations, such as for example an E-UTRAN (evolved Universal Mobile Telecommunications System Terrestrial Radio Access Network) NodeB base station serving macro cells, and one or more small cell base stations serving small cells. For example, a small cell base station (or a wireless access point or a remote radio head, for example) may be implemented to cover a small cell, or coverage area, examples of which include a residence, a small business, a building, an office, or a small area. The small cell base station, such as for example a home base station (HNB), a home E-UTRAN NodeB base station (HeNB), a WiFi access point, and the like, may be configured to have some of the functionality found in a typical base station, such as for example an E-UTRAN NodeB (eNB) base station, but the small cell base station may have less/smaller coverage/range and lower power capabilities given its limited coverage area or class. Furthermore, small cell base station may have limited (or non-ideal) backhaul connection that may have higher latency or lower throughput than macro cell base stations. This limited backhaul connection may affect communication between small cell base station and other base stations and other network elements or nodes. For example, the small cell base station may be implemented as a femtocell wireless access point/base station having power sufficient for a cell serving wireless devices within a limited range of about tens of meters. Picocell base stations are another example of a small cell base station, but picocell base stations have somewhat greater range serving a small area on the order of about 100-200 meters. The small cell base station may be implemented as a secondary base station, for example, a secondary cell (SCell) eNB in carrier aggregation. It may also be called a secondary eNB (SeNB). Accordingly, wireless service providers view small cell base stations as a way to extend service coverage into a small cell, as a way to offload traffic to the small cell base stations, and/or as a way to provide enhanced service, such as for example higher data rates, lower latencies, energy efficiency and the like, within the small cell, when compared to the larger macro cell served by a typical base station, such as for example the eNB base station. The macro cell base station may be also implemented as a primary base station, for example, a primary cell (PCell) eNB in carrier aggregation and may also be called master eNB (MeNB).

SUMMARY

[0004] Various aspects of examples of the invention are set out in the claims.

[0005] According to a first aspect of the present invention, an apparatus comprising: at least one processor; and at least one memory including computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to perform at least the following: receive configuration information including a timer value associated with user data inactivity; start or restart a timer when user data is active in at least one cell of a secondary cell group but not when user data is active in a cell of master cell group; and release dual connectivity if the timer expires.

[0006] According to a second aspect of the present invention, a method comprising: receiving configuration information including a timer value associated with user data inactivity; starting or restarting a timer when user data is active in at least one cell of a secondary cell group but not when user data is active in a cell of master cell group; and releasing dual connectivity if the timer expires.

[0007] According to a third aspect of the present invention, a computer program product comprising a non-transitory computer-readable medium bearing computer program code embodied therein for use with a computer, the computer program code comprising: code for receiving configuration information including a timer value associated with user data inactivity; code for starting or restarting a timer when user data is active in at least one cell of a secondary cell group but not when user data is active in a cell of master cell group; and code for releasing dual connectivity if the timer expires.

[0008] According to a fourth aspect of the present invention, an apparatus comprising: at least one processor; and at least one memory including computer program code, wherein the at least one memory and the computer program code are configured to, with the at least one processor, cause the apparatus to perform at least the following: transmit configuration information including a timer value associated with user data inactivity, wherein the timer value is associated with release of dual connectivity if a timer which counts time of user data inactivity expires.

[0009] According to a fifth aspect of the present invention, an apparatus comprising: means for receiving configuration information including a timer value associated with user data inactivity; starting or restarting a timer when user data is active in at least one cell of a secondary cell group but not when user data is active in a cell of master cell group; and releasing dual connectivity if the timer expires.

[0010] According to a sixth aspect of the present invention, an apparatus comprising: means for transmitting configuration information including a timer value associated with user data inactivity, wherein the timer value is associated with release of dual connectivity if a timer which counts time of user data inactivity expires.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] For a more complete understanding of example embodiments of the present invention, reference is now